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Magazine

THE PRESIDENT REPORTS ON THE FUTURE OF JOHNS HOPKINS

A physicist looks at the light source used for spectroscopic investigation of rare earth salts at liquid helium temperatures in a magnetic field.

February 1961
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THESE MEN ARE SCHOLARS . . .

Dedicated to truth, they seek to understand the world they live in. They are probing the unknown and pushing back the barriers of ignorance in every area of human endeavor. The hope of mankind is expressed in what they are trying to do, and the future may well be determined by their achievements.

A physical chemist builds a special unit for the excitation of Raman spectra which he will use to determine the structures of molecules.

By removing part of the brain in a long and complex operation, a neurosurgeon brings relief to a victim of epilepsy.

Artifacts from ancient Arabia provide an archaeologist with important knowledge about man's early civilization.

To learn the mechanism of photosynthesis, a biochemist studies the change of light energy into chemical energy.

. . . *IN AN ENDLESS QUEST FOR UNITY.*

Passing knowledge and understanding from one generation to the next, these men bridge the ages and give to civilization a vital intellectual continuity.

A political scientist meets in a unique seminar with diplomats from newly independent nations.

To study the interaction of particles, a high energy physicist measures tracks from a bubble chamber experiment.

In his study of vortices, an engineering scientist analyzes the motion of fluid in a spinning tank.

THEY ARE THE HEART OF THE UNIVERSITY—

SYMBOL FOR AN AGE

On September 25, 1960, as the University prepared for its annual autumnal rejuvenation, newspapers across the nation featured news of dramatic importance to American higher education. The Ford Foundation had announced a Special Program in Education, consisting of substantial unrestricted grants to five privately supported universities. In the words of Dr. Henry T. Heald, president of the Foundation, the objective of the program "is to assist institutions in different regions of the country to reach and sustain a wholly new level of academic excellence, administrative effectiveness, and financial support." As one of the institutions selected to participate in the program, Johns Hopkins received a conditional grant of $6,000,000, the largest single donation of funds for general purposes in the University's history.

I had known for some months that Hopkins was one of the institutions being considered for inclusion in this program. I had known for some time prior to the public announcement that we had succeeded in making our case to the Ford Foundation. Nonetheless it was with a feeling of joy and satisfaction that I read the newspapers on that September Sunday, for I felt that I was sharing the feelings of pride and accomplishment which were the rightful lot of every member of the far-flung Hopkins family.

Shortly after the Ford Program was announced, I found myself confined to bed with a fashionable but nonetheless painful back injury. Thus incarcerated for the better part of two months, I found it possible even so to carry on much

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Illustrations by
ROBERT ROSS

University business from my bedside. The worst part of it was the loss of so much personal contact with students, faculty, alumni—a facet of university administration I had come to relish over the course of many years.

But seemingly it is true that everything has its compensations. The long hours of convalescence provided opportunity for reading and reflection, luxuries greatly to be cherished by all twentieth-century university presidents. I had a chance to take an unhurried view of the Johns Hopkins University and the vast spectrum of its current activities. I had not only the opportunity but the obligation to try to place our plans for the future in a larger context of essential meaning.

One day I happened to pick up *The Education of Henry Adams*, a book which I had read many years ago but whose full meaning had grown dim in the interval. It is a curious work written in an end-of-the-century manner of brooding detachment. Curiously prophetic, what Adams had to say about Russia, about an evolving "Atlantic System," and about the acceleration of technological progress makes for interesting reading more than a half-century later. But what strikes the casual reader most suggestively is Adams' symbolic treatment of the dynamo and the Virgin.

To Henry Adams both of these were symbols of power. The figure of the Virgin Mary beautifully expressed the compelling and awe-inspiring force of religion in the middle ages. It was the power which had built the magnificent cathedral of Chartres. As a student of power in human history, Adams was not one to deprecate the forces which modern man had harnessed, but he was at pains to point out that "all the steam in the world could not, like the Virgin, build Chartres."

Moving from the middle ages to the early twentieth century, Adams saw the dynamo as the symbol of power in his own time. After viewing an exhibit of these great machines at the Paris Exposition of 1900, Adams came to regard the dynamo as "a moral force." "Among the thousand symbols of ultimate energy, the dynamo was not so human as some, but it was the most expressive." It was, however, the symbol not of force controlled but of force run wild, anarchic and essentially irresponsible.

Adams was profoundly concerned with the implications of his analysis. Though the Virgin and the dynamo were both symbols of force, the former represented the concentrated power of a single idea, whereas the latter seemed to typify the dissipation of force. The Virgin stood for the unity and certainty of the middle ages; the dynamo was a symbol of multiplicity and uncertainty. Adams thought he saw a law of acceleration governing the movement from unity to multiplicity from 1200 to 1900 A.D. Where the

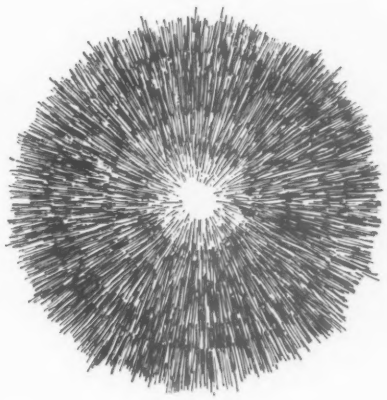
process would end, no man could foretell, but he did not doubt that even greater forces would be unleashed:

"At the rate of progress since 1800, every American who lived into the year 2000 would know how to control unlimited power. He would think in complexities unimaginable to an earlier mind. He would deal with problems altogether beyond the range of earlier society. To him the nineteenth century would stand on the same plane with the fourth—equally childlike—and he would only wonder how both of them, knowing so little, and so weak in force, should have done so much."

But could man really learn to control such power? Adams wondered if the human mind had not already "entered a field of attraction so violent that it must immediately pass beyond, into a new equilibrium, like the Comet of Newton, to suffer dissipation altogether, like meteoroids in the earth's atmosphere."

These reflections by a great American historian actually seem to have gained in pertinence as we enter upon the seventh decade of the twentieth century. The amount of force at the disposal of human beings today would surely startle even Henry Adams. In all honesty, however, I fear we must confess that the question of the ability of man to harness this incalculable energy for good instead of evil is still moot.

I found myself wondering what Adams would accept as a meaningful symbol of our own age. The Hiroshima bomb came immediately to mind. Since 1945 it had achieved universal recognition as a symbol of power. But the sequence of symbols confused. The atom bomb had been made obsolete by the hydrogen bomb which in turn might soon be displaced by a cobalt bomb. Adams' law of acceleration was obviously at work. A recent publication informed me that if we represented the power of a World War II blockbuster by a one-foot ruler, then the bomb that destroyed Hiroshima would be represented by the height of the Empire State Building, and the twenty-megaton hydrogen bomb would appear on this scale as the height of an orbiting earth satellite. And, of course, the satellite itself seemed a thoroughly valid symbol. Yet none of these satisfied. Motion was too rapid. The main effect induced by such thinking was vertigo.



I began to doubt that any such example of physical force could satisfy as a valid symbol for our age. The symbol should possess to some extent the quality of timelessness, and it was obvious that the time intervals between different stages in the development of physical force were becoming shorter and shorter.

It was perhaps inevitable that the idea of the free university should come to my mind. I resisted it because the

motive of self-interest seemed to be involved, but the more I turned the idea over in process of reflection, the more I became convinced that here was, indeed, a symbol of considerable power and meaning.

I found it appealing that the concept of the university had been able to withstand the ravages of time. One of the most viable of human institutions, its origins antedate even the Gothic cathedrals which Henry Adams loved so well. This quality of antiquity added to the value of the free university as symbol for our age, but it was at the level of ultimate meaning that its suggestiveness became irresistible.

Of all human institutions the university has for centuries been the one most intimately concerned with the necessary accommodations between unity and multiplicity. Its contributions to multiplicity cannot be denied. In every century since the middle ages Western man has looked to the universities not simply as repositories of ancient wisdom but also as crucibles where by some mysterious alchemy the store of knowledge is constantly increased. The point is too obvious to need belaboring. To write the history of what the scholars and scientists of our Western universities have accomplished would be virtually to write the history of Western civilization.

Though largely responsible for multiplicity, the free university has traditionally committed itself to the search for unity—to the unceasing though sometimes unsuccessful effort to bring philosophical order out of fragmented chaos. My dictionary tells me that the very word university is taken from two Latin words which mean "turned into one" or "combined into one whole." I do not want to grasp at straws, but will nonetheless accept this etymological evidence that a university is necessarily concerned with unity. Many of the great syntheses of the western world have been associated with the universities—that of St. Thomas and the medieval Church, of Isaac Newton's mechanics, of the Manchester school of economics, of Einstein's theory of relativity. Difficult though the task may be, the free university cannot shirk its age-old responsibility in this realm. It must continue and intensify its effort to bring unity out of multiplicity, for in this direction lies the surest escape from disaster.

On this basis I find myself prepared to accept the free university as a valid symbol for our time. The university has become the focal point both for the staggering multiplicity growing out of the current "knowledge explosion" and also for efforts to achieve such unity of thought and purpose as will enable us to use this knowledge for human betterment rather than human destruction. What better symbol for a time when all our hopes are expressed in what our free universities are trying to do?

Such symbolism seems valid in the abstract, but it is only in concrete terms that the free university's role becomes fully meaningful. As I survey the current scene at Johns Hopkins, I find much evidence that the University is creatively carrying out this historic mission. It is in this vitally important context that I would like to discuss a variety of exciting activities and plans which range across the entire breadth of the academic spectrum.

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HISTORY AND PHILOSOPHY OF THE ARTS AND SCIENCES

In his Rede lecture at Cambridge University in 1959, Sir Charles Snow called attention to "two cultures" existing side by side in the Western world but with virtually no connecting links. On one side there is the cultural world of the scientists, dynamic, vigorous, essentially optimistic. On the other side we find the cultural milieu of the humanists, by nature less dynamic, much more concerned with traditional values, and something less than optimistic about the ability of science to control the new forces increasingly brought to bear on the fabric of society. Between these two worlds there exists tension, lack of sympathy, and a vast amount of misunderstanding.

The situation may not be quite so bad as Snow depicted it. Even today there are some individuals, including C. P. Snow himself, who can bridge the gap between the "two cultures." I think it also true that the reason this lecture was so widely discussed is that more and more people, particularly in our universities, are aware that the problem does exist and they are determined to do something about it.

This is certainly true at Johns Hopkins where we have projected an ambitious and, I think, well-conceived new program in the History and Philosophy of the Arts and Sciences. There are several advantages deriving from the nature of the University which will operate to give this program greater coherence and meaning than it might otherwise have. First of all, we are a relatively small institution without the rigid departmental barriers which characterize so many of our larger sister universities. Perhaps because of this, our scholars and students have tended to possess a greater catholicity of interests which has shown itself in the very considerable amount of inter-disciplinary research and teaching which has always been carried on at Johns Hopkins. Thus, while the problem of communication between scientists and humanists does exist at the University, it would appear by no means insurmountable.

In the various departments of the social sciences and the humanities a good deal of course and seminar work at both the undergraduate and graduate levels is currently con-

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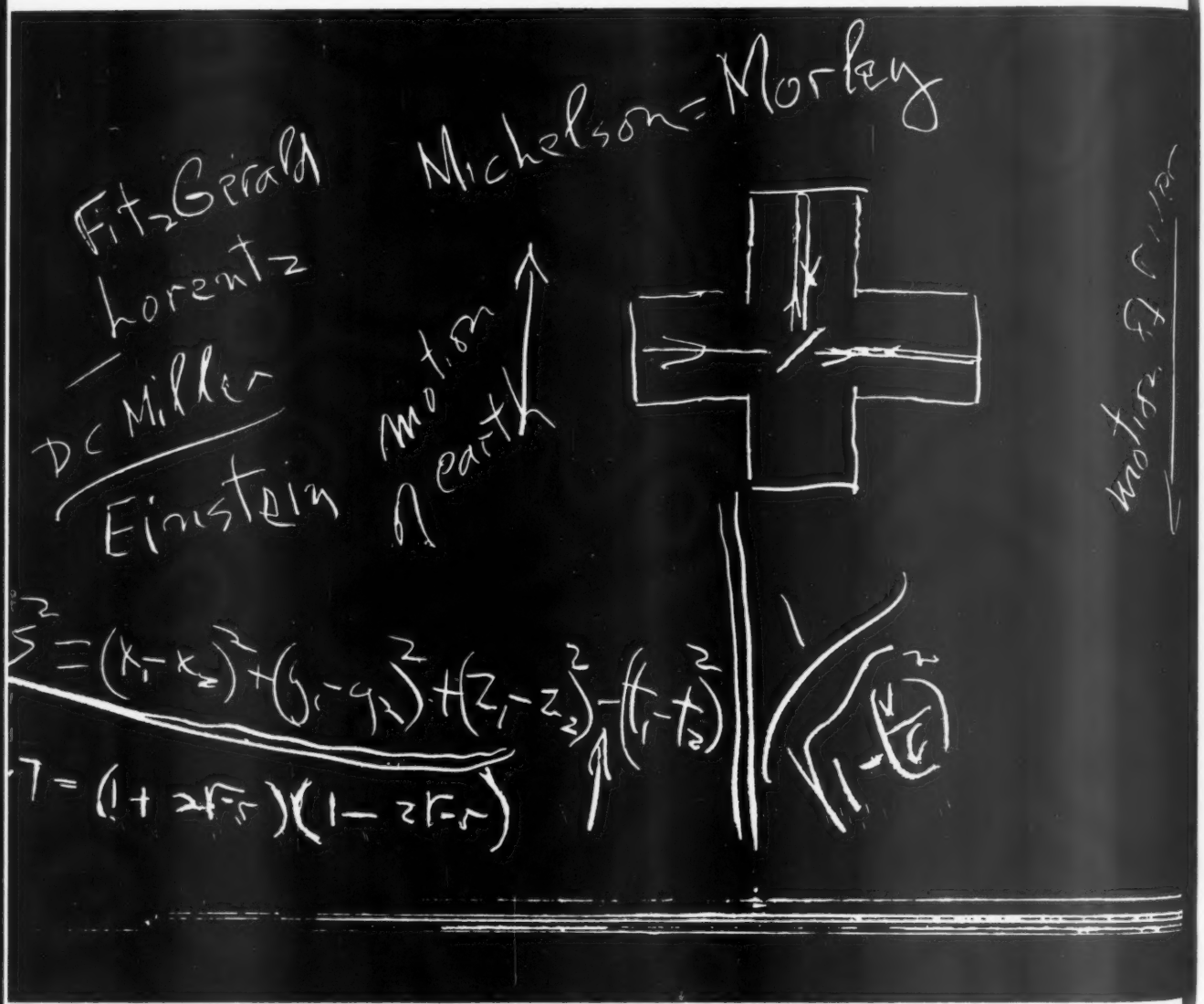
From a lecture in the history of science, blackboard notes on the famous Michelson-Morley experiment, which attempted to measure the earth's velocity. The negative results formed the starting point of Einstein's theory of relativity.



cerned with historical and philosophical aspects of the liberal and fine arts. While little expansion will be required in these areas, there is a very real need for development of a parallel sphere of activity devoted to the history and philosophy of the natural sciences.

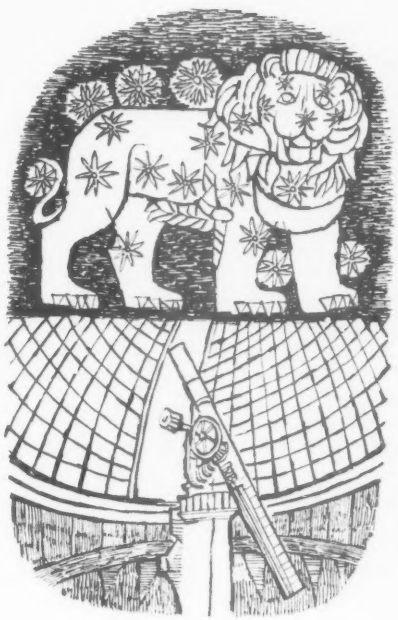
I am convinced that this development will be of great importance to our undergraduate students. However, the program will not be what it has sometimes been at other institutions, namely a device by which students in the social sciences and humanities escape the rigors of a science requirement. Courses in the history and philosophy of science will be offered in addition to the Hopkins requirement of a full-year natural science course, not instead of it.

We are presently planning a basic one-term course which will introduce students to the nature of scientific inquiry through examining one major period in the development of modern physical science. The sixteenth and seventeenth centuries, for example, would confront students with a period of great importance in physics and astronomy, but a consideration of the problems which faced Galileo, Kepler, and Copernicus would not require elaborate preparation in mathematics and physics. Possibilities for other course offerings suggest themselves. One course might be devoted to exploring the major historical developments within the biological sciences; another might be concerned with more recent and more technical problems in the later history of the physical sciences; another might deal with the transformations produced by the technological applications of scientific discoveries.

Such courses will be of value to all our undergraduates, but I think they will be of particular value to our science students whose experimental and theoretical work is becoming increasingly specialized and who can profit greatly from the unifying concepts of history and philosophy, *especially as applied to science itself*.

There are also plans for expanding opportunities in this area at the graduate level. While it is not expected that many graduate students in the science departments will want to concentrate on the history and philosophy of their specialty, they can certainly profit from a certain amount of such study in courses and seminars. A number of graduate students in the social sciences and humanities will more than welcome the chance to increase their understanding of the vital forces of science and technology.

Several new appointments to the faculty will be required to launch this program. We are seeking men of outstanding ability in the field. I feel that this will be a development of great importance to the future of the University and that it merits all the effort necessary for a successful consummation.



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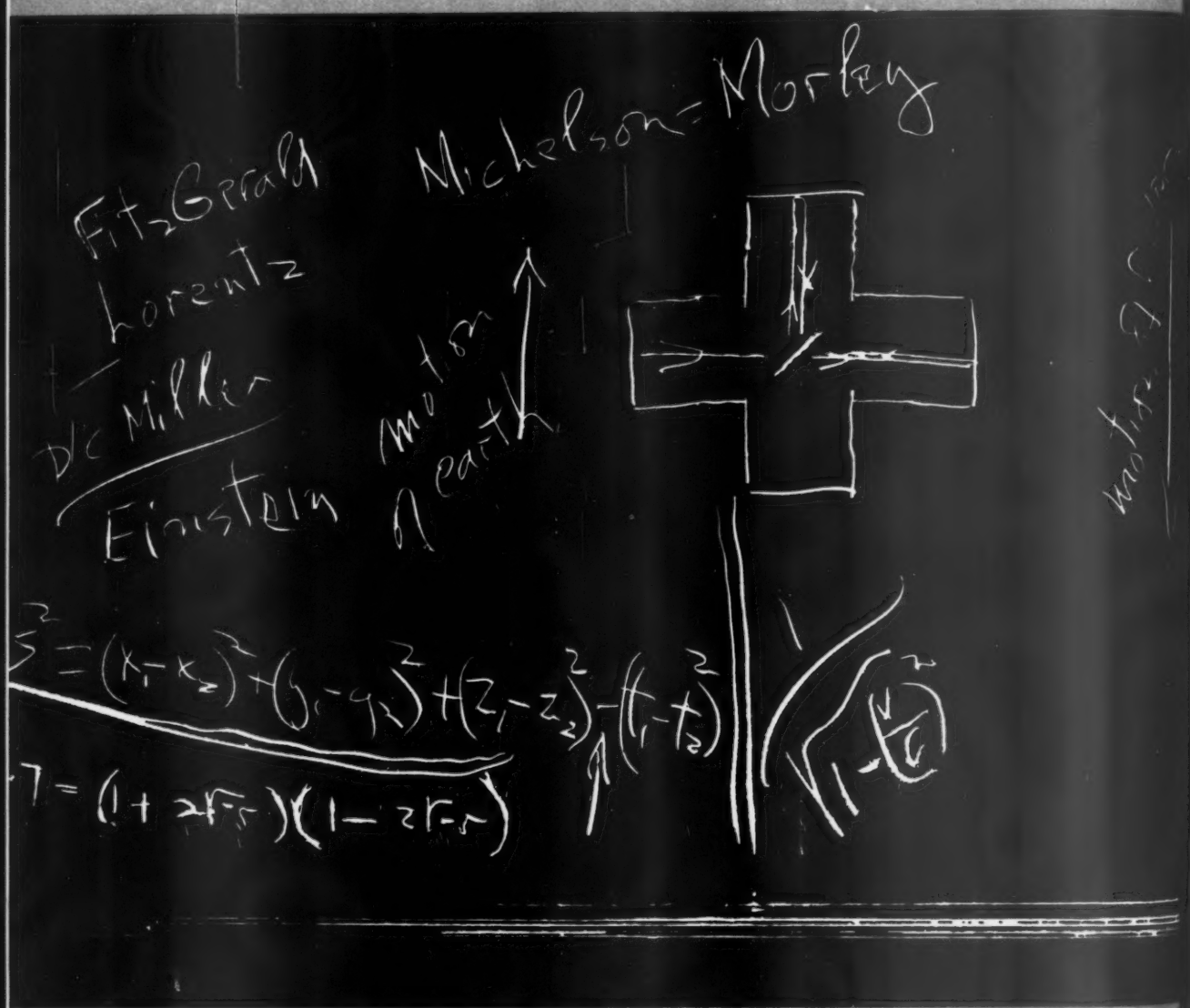

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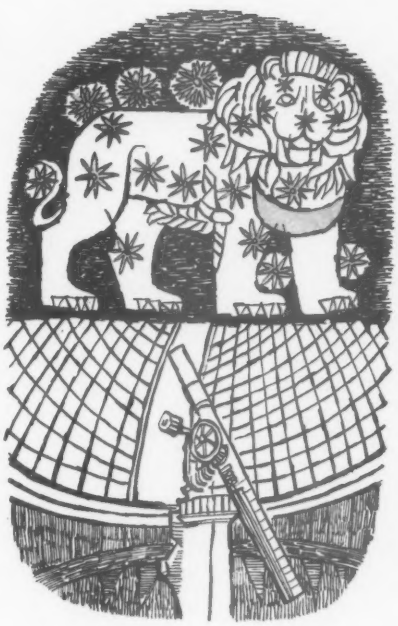

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A NEW RESEARCH LIBRARY

THOMAS CARLYLE once said that the true university is a collection of books. In a great university library, amid the thousands of books, periodicals, microfilms, and manuscripts, people go about their business with quiet intensity. Here you may observe the young undergraduate completely absorbed in tomorrow's assignment in beginning economics. By his side sits the senior scholar tracking down a reference, equally oblivious to the passing parade. In this setting one becomes aware not only of the democracy of knowledge but that such activity is the distilled purpose of the university. Johns Hopkins simply could not exist without its library. It is our citadel of knowledge, the physical and spiritual heart of the University.

In the University's library the problems of multiplicity growing out of the "knowledge explosion" take on an awesome physical reality. In less than twenty years the resources of the Hopkins library have doubled to a present total of nearly 1,200,000 volumes. Last year 78,671 separate items were acquired. Of these, more than 20,000 represented bound catalogued volumes. The library annually acquires more than 6,500 serials, including journals, annuals, proceedings, and publications of the various learned and academic societies. These acquisitions are not made because the University has a passion for hoarding. They are part of a planned program which has been deemed absolutely necessary to the continuing productivity of a scholarly community.

The effects of the sheer physical bulk of this explosion of knowledge are readily apparent to even the casual visitor to Gilman Hall where the main University collections are housed. Brilliantly designed to serve the needs of a more leisurely academic age, the library today is virtually bursting at the seams. Every year that passes finds shelf space at a greater premium. Thousands of items are housed in marginal and sub-marginal areas. Facilities for the storage, care, and servicing of photographic materials are primitive at a time when an ever-increasing proportion of library material is available in the form of microfilms or microcards. Study space for faculty and students is wholly inadequate. The main reading room and the various subject specialty reading rooms are increasingly ill-equipped to meet the tremendous demands placed upon them.

For the past four years the present and projected library needs of the University have been intensively studied by various groups including members of the faculty, the board of trustees, and the administration. A plan for future development has been conceived which is at once bold and imaginative but also manages to retain those distinguishing features which have made the Hopkins library over the

years so unusually effective in its total dedication to the ideals of a community of scholars.

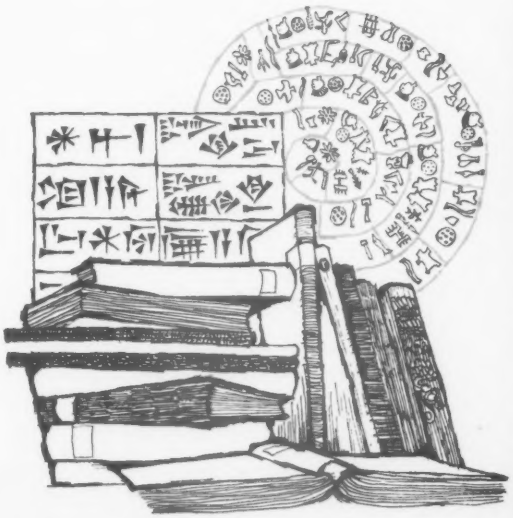
The plan calls for the construction of a new research library at the eastern end of Keyser Quadrangle facing Gilman Hall and also overlooking the Bowl. Such a commanding location in filling out the upper quadrangle will serve to emphasize and symbolize the key position of the library in the life of the University. It will be a large building with eight separate levels and a total area of nearly 200,000 square feet. In order to achieve harmony with adjoining buildings as well as maximum efficiency of operation, it is likely that as many as four levels of the new library will be underground. The building will be designed to accommodate approximately 1,500,000 volumes, sufficient to meet projected needs until at least the year 2000.

This will be a research library calculated to meet the needs of a community of scholars. It will exist, however, not only for faculty and graduate students but also for undergraduates who are acquiring sophistication in the methods of research. In this way the new library will become a powerful adjunct to the total undergraduate program.

Many of the features of our new library will be so exciting and so truly useful in the University community that I find myself yearning almost daily to see these plans quickly made real. There will be a large bibliographical center where the scholar may quickly find relevant sources. Here will be not only card catalogues of the Johns Hopkins collections and those of other libraries in Baltimore but also the printed catalogues of the Library of Congress, the British Museum, and the *Bibliotheque Nationale*. Specially trained librarians will be able to guide scholars to collections in archives and libraries throughout the world.

At last Johns Hopkins will have the appurtenances so useful in sustaining creative effort. Students will have small studies or carrels attractively furnished and located close to the book collections around which their work is centered. Faculty members will have individual studies with full assurance of the privacy and solitude so necessary to the true scholar. And, to bring students and faculty members together, the new library will contain seminar and conference rooms near the studies and carrels, as well as a 200-seat lecture room.

Over the years the Johns Hopkins library has accumulated a sizable collection of rare books. A new library building will make it possible for the first time to care for these treasures properly and to make them more generally available to the University community. Such facilities will also encourage owners of valuable private collections to bequeath their books to the University. Not only the very old but also the most modern apparatus of scholarship can



be accommodated and utilized. Photographic slides, tape and disc recordings, materials useful in the study of art, science, language, and literature—all can be made available for purposes of instruction and research.

In terms of unity and multiplicity I think this new library will beautifully symbolize the University's historic function. It will have the physical capacity to contain the "knowledge explosion" for years to come but the commitment to unity will be implicit in a structure which, for the first time, will house collections now scattered in many different buildings throughout the campus. The structural unity should produce much desirable cross-fertilization. No longer will the engineer be reluctant to explore materials in the behavioral sciences simply because they are located in an alien collection hundreds of yards away. No longer will the social scientist shy away from the exploration of relevant biological data because he finds them difficult to locate.

A new research library will give us the flexibility so seriously lacking at the present time. It will be possible to continue to make full use of the present library space. The main reading room in Gilman Hall will be converted into an undergraduate library for the use of both day and night students. A basic collection of approximately 20,000 volumes will be housed in this division of the library, and it will be staffed by personnel trained to give information and guidance to undergraduate students.

The importance of this new research library to the future development of Johns Hopkins cannot be overemphasized. I sincerely believe it is absolutely necessary if the University is to reach its full potential in the coming years. Of all the construction projects for which funds must somehow be found, it has the highest priority. I fervently hope that every friend of the University will help us to accumulate quickly the financial resources essential to make the new library a thrilling reality.

ENGINEERING SCIENCE

IN FEW FIELDS of education are the issues involving unity and multiplicity more clearly drawn than in engineering. Intimately involved in the practical applications of basic scientific discoveries, engineers are largely responsible for the western world as we know it today. As technology has become more complex and diffuse, the number of engineering specialties has increased at a fantastic rate. Many of the specialties in which advanced engineering training is given today did not exist thirty years ago.

Until a few years ago the trend in engineering education was toward ever-increasing specialization. More and more

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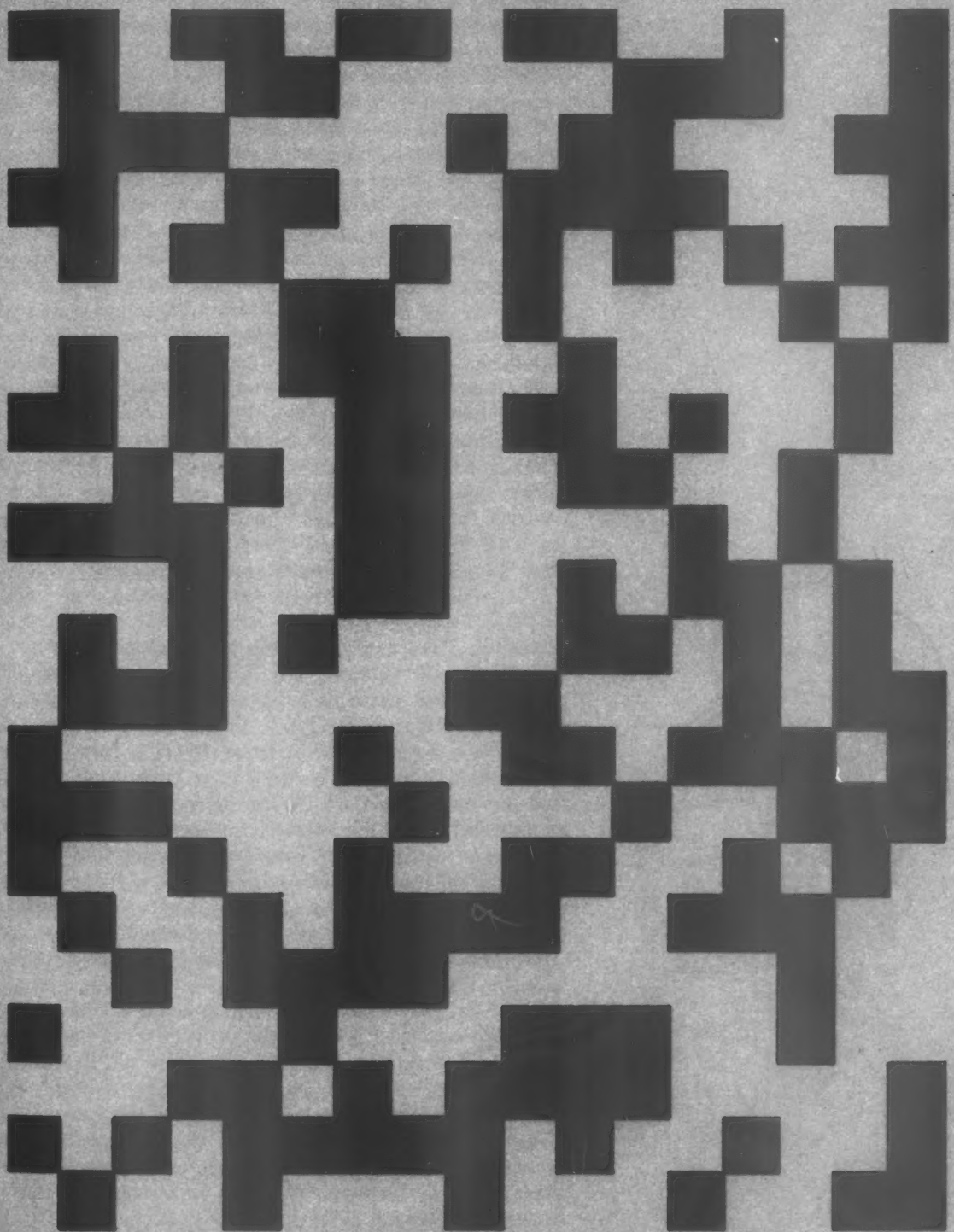

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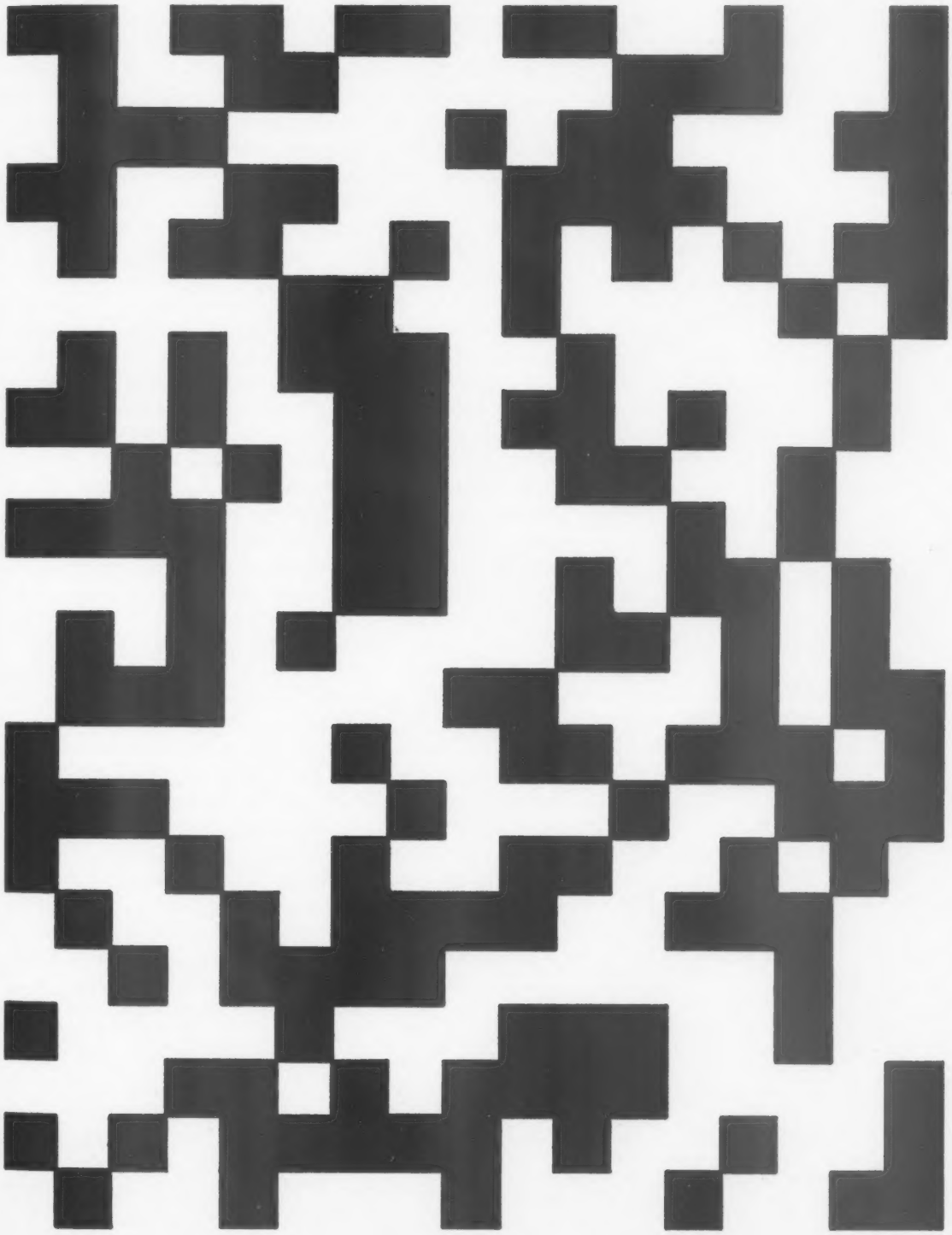
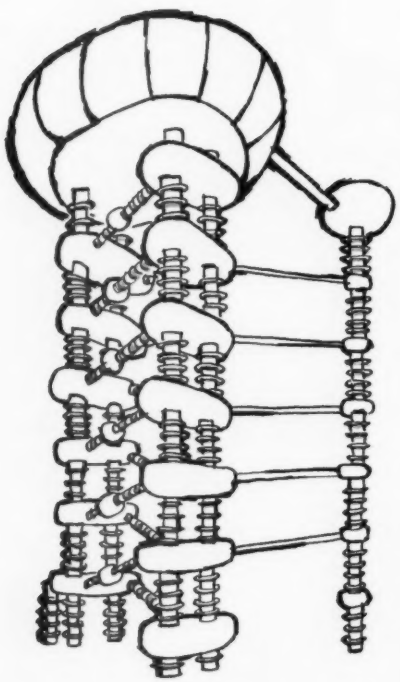


intensely practical "how-to" courses found their way into the various schools. Both industry and schools of engineering seemed to accept the proposition that it was the business of the universities to turn out more and more specialists in limited areas of technology.

In 1951, the Johns Hopkins School of Engineering consciously set out to reverse this trend. I think it particularly fitting that this movement should have been initiated at a university which has long subscribed to the belief that true education consists of a knowledge of principles rather than methods. In reassessing its curriculum the School of Engineering dropped a number of specialized and practical courses. This made it possible to place much greater emphasis upon basic sciences and those tool subjects fundamental to all branches of engineering. Students in engineering were also exposed to more work in the social sciences and the humanities.

The essential meaning of this revised program lay in its insistence that growing complexity should be dealt with not through narrower and narrower divisions of labor but rather through an educational philosophy emphasizing a unified basic scientific approach to a wide range of technological problems. The aim was to produce engineers who are truly educated and creative individuals, not merely cogs in an increasingly complex industrial machine.



The revised program in engineering was an experiment in 1951. Today we can say that it has been completely successful. More and more engineering schools have come to see the problems in the same light and have made modifications in their curricula very similar to those made at Johns Hopkins.

Confident that we are moving in the right direction, the Engineering Faculty has projected for the coming years a plan for integrated training so different from anything existing today that it constitutes an entirely new concept in technological education. Greatest emphasis will be placed upon the fundamental unity of the sciences. Rigid departmental barriers will yield to a new approach stressing inter-relationships among the various disciplines.

Developments of the past year show clearly the direction in which the School is moving. The former departments of aeronautics, civil engineering, and mechanical engineering have been combined into a single department of mechanics under the chairmanship of Dr. George S. Benton. This action was taken after much study had demonstrated that theoretical and experimental problems in the broad field of mechanics could not be treated adequately within the confines of narrow departmental structures. Dean Roy has given an excellent example of this in his recent letter to the engineering alumni: the behavior of an ionized gas in a

magnetic field; the mechanics of our atmosphere; the flow of a fluid through a turbine; and the subsurface motion of a stratified mixture of fresh and brackish water to a well—all have fundamental similarities in their physical behavior and in the relationships by which they are described.

Within the new department of mechanics such problems will not be studied in fragmented isolation. Instead, a wide variety of knowledge and skills will be utilized to discover the basic principles common to each of these phenomena. The creation of the new department has been enthusiastically approved by the advisory board of the School, by its visiting committee, and by the board of trustees. It is, I believe, a pioneering step in engineering education.

In the near future I anticipate another important development in the School of Engineering. This will involve the introduction at the undergraduate level of a series of "master" courses bearing such titles as "Theory of Measurement and Experimentation," "Linear Systems," "Theoretical Mechanics and Nonlinear Systems," "Electricity and Magnetism," "Statistics," and "Systems Engineering." These basic subjects will be presented in a uniform manner by members of the faculty representing several different areas of specialization. The constant focal point of each of these courses will be the basic unity of the engineering sciences as shown by the applicability of basic principles to a wide variety of fields and situations.

The projected long-range program for the School of Engineering will also have a profound impact upon graduate education. It is expected that a considerable expansion of graduate enrollment in engineering will be found both necessary and desirable. The unified scientific approach to technological problems inculcated in the undergraduate curriculum will provide the ideal background for the necessary specialization of the advanced degree programs. The philosophy, however, at each level of training will be to deal with complexity through unity. By emphasizing basic principles derived from many different disciplines, it will be possible to forge ahead in those very important specialties such as fluid mechanics, plasma dynamics, physical metallurgy, and operations research which no longer recognize the artificialities of compartmentalization.

MEDICAL EDUCATION

THE SEARCH for unity in the field of medicine is complicated by problems that are reaching crisis proportions. The amazing progress of medical science in the past fifty years has yielded so much new knowledge that the traditional four-year medical curriculum is inadequate to encompass it.

Equally perplexing is the fact that time and expense involved in earning the M.D. and completing post-doctoral work are so great that many potential medical students are entering other sciences where they can earn their degrees in less time and where attractive student aid programs considerably ease the financial burden. As a result, the number of applicants to medical schools has declined each year since 1957. This is an alarming trend, and one which must be reversed if the nation's health is not to be endangered.

Johns Hopkins is meeting these problems decisively. In the fall of 1959, the School of Medicine became one of the first to initiate a revised program in medical education which lets students begin medically-oriented studies after the second year of college and provides medical students with more than thirty weeks of uncommitted time for independent study and research. The revised medical program has been thoroughly reported. I need only say here that it is living up to our expectations. Medical students at Johns Hopkins do not reflect the decline in the quality of medical applicants which is troubling the nation's medical educators. Our students are truly graduate students of medicine, concentrating on the scientific principles which will enable them to understand and stay abreast of the rapid changes in medical science.

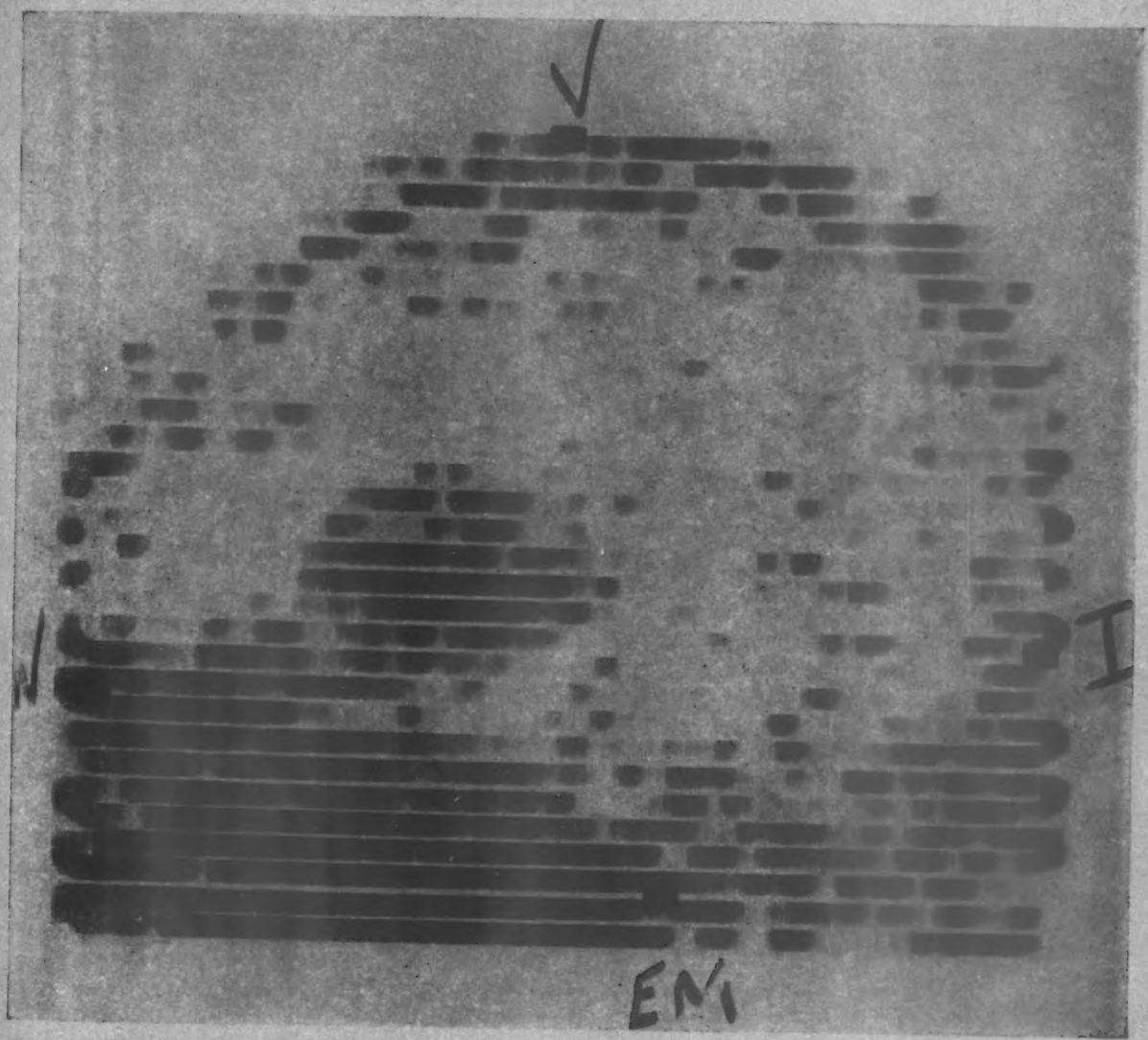
Next fall, the School of Medicine takes another step forward by increasing its enrollment—the first major expansion in thirty-five years. The entering class in September, 1961, will be increased from seventy-five students to ninety. Similar increases in the succeeding three years will raise the total enrollment in 1964 to 360, an increase of 20 per cent over the present 300.

Important as these developments are, they are causing no complacency. Our Medical Faculty is accustomed to moving forward, to leading the way, and it continues its search—not only for new knowledge, but for new and better ways to train the medical scientists and medical teachers which America must have.

RADIOLOGICAL SCIENCES

No AREA of research and education appears to dramatize the free university's symbolic significance more completely than the effort to control nuclear energy. Our universities were intimately involved in that long probing of the secrets of the nucleus which resulted in the historic flight over Hiroshima in 1945. Though sharing much of the glory for this unprecedented releasing of physical force, they are fully aware that they have a deeply moral commitment toward harnessing this vast energy for constructive purposes.

A radioactive scintiscan indicates a brain tumor (center left) where isotopes injected in the patient have concentrated.



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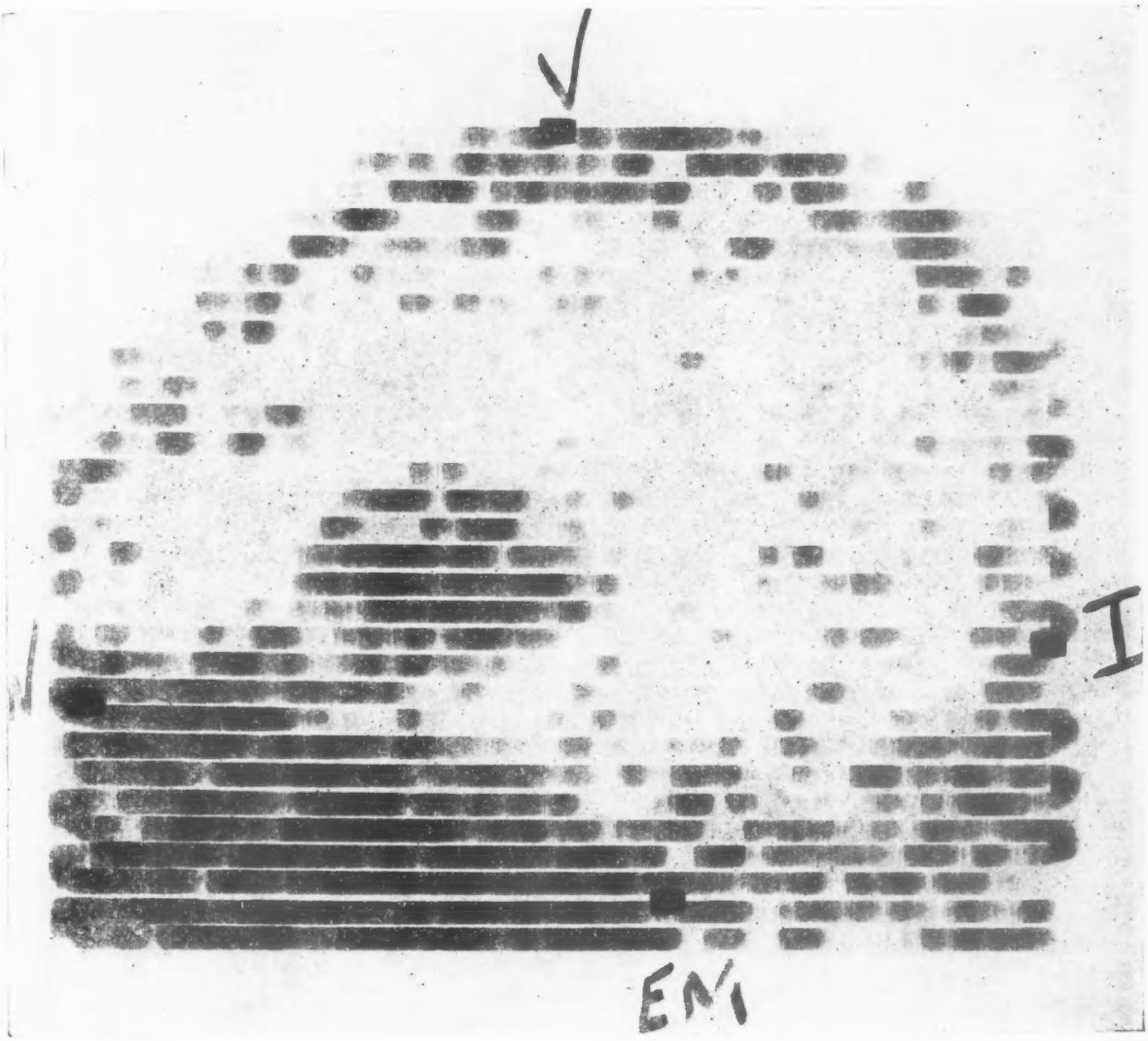
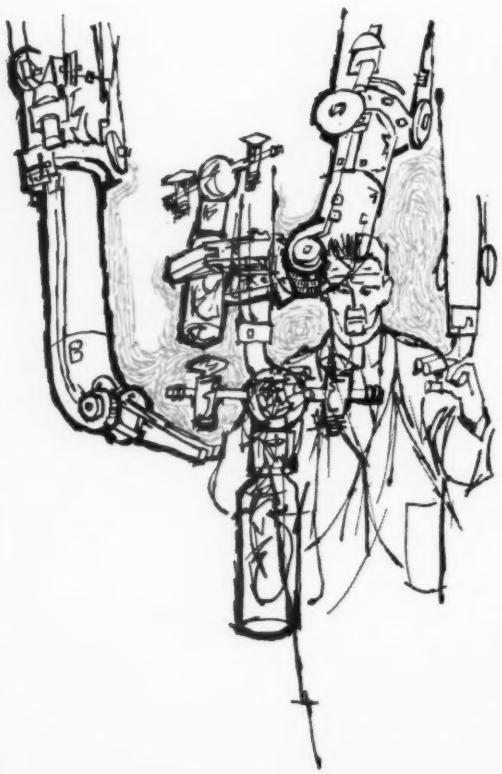


There are many aspects of this effort to control the results of fission and fusion. It commands the attention of physical and biological scientists, social scientists, humanists, and philosophers. It is never any more remote to any of us than yesterday's newspaper.

Johns Hopkins has projected plans for a large-scale program of research and education in the radiological sciences. I feel that the University is in an excellent position to become the national leader among educational institutions in this crucially important field. I am sustained in this opinion by the strength of Johns Hopkins in such relevant subject areas as nuclear physics, geophysics, biophysics, biochemistry, physiology, biology, radiology, food chemistry, public health, and medicine. Each of these disciplines will have a part to play in solving a very basic problem. Simply put, that problem consists of understanding, preventing, and, when necessary, treating the biological and destructive effects of hard nuclear radiation on man. In terms of understanding, prevention, and treatment, these new specialties are known as radiobiology, radiation hygiene, and radiation medicine.

At the present time a good deal of research on various aspects of this basic problem is being carried on in universities and laboratories throughout the country. There is a real need, however, for an integration of this work. What is lacking is a laboratory and an organization where the complicated interdisciplinary integration needed for understanding can take place—where daily and close discussions among specialists in various areas are seen to be both desirable and necessary.



Johns Hopkins is well equipped to bring about such integration, not only because it is strong in the relevant subject areas but also because it is associated with an outstanding research and teaching hospital. In the past year the University has moved to give this fruitful concept a positive reality. Dr. Russell H. Morgan, a world recognized authority in the field, has been appointed head of a new Division of Radiological Science. Dr. Morgan is in an excellent position to coördinate the work in this area inasmuch as he also holds the positions of professor of radiology in the School of Medicine, professor of radiological science in the School of Hygiene, and radiologist-in-chief of the Johns Hopkins Hospital.

At the present time plans are well advanced for the construction of an addition to the School of Hygiene and Public Health building which will house many of the projected activities in the radiological sciences. Financial support from the National Institutes of Health and from interested foundations seems assured, as does the enthusiastic coöperation of the Public Health Service and the Atomic Energy Commission.

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POST-DOCTORAL STUDY

Some of the problems of multiplicity seem to generate remedies outside the framework of any master plan. Post-doctoral study is one answer to the "knowledge explosion," but it has grown like Topsy, heavily concentrated in certain specialties and rare in others. A recent study of graduate education in the United States has directly related the increasing number of post-doctoral students to "the constant increase in the amount of material to be mastered." This point becomes all too apparent when it is realized that a recent year witnessed the publication of 55,000 journals containing 1,200,000 articles dealing with the physical and life sciences alone.

The rationale for the growth of post-doctoral study is reasonably clear. In many fields it can no longer be assumed that achievement of the doctorate marks a terminal point in the formal educational process. Instead, mastery of the vast outpouring of knowledge in an ever-increasing number of specialties and the attainment of true creativity often require one or more years of intensive post-doctoral study. This study may be closely supervised by senior professors or it may be conducted more or less independently by mature scholars following their own research inclinations. Altogether this burgeoning of studies beyond the doctorate is so important that it would seem to constitute virtually a new dimension in education.

Twenty years ago about 260 post-doctoral students were in residence at the University. Today the total is 585, an increase of 125 per cent. In relation to its size, Johns Hopkins today has a greater proportion of post-doctoral students than any university in the United States. I think we can take pride that the University has become something of an intellectual Mecca for these highly talented and creative individuals.

While the rationale for post-doctoral study is clear, its structure is not easy to comprehend or to describe simply. There are a number of categories of post-doctoral students. At Johns Hopkins, for example, there are 278 University fellows who serve as interns, assistant residents, and residents at the Medical Institutions. There are also ten fellows-by-courtesy at Homewood who are distinguished scholars of another university or similar institution to whom the facilities of the University are extended. Other categories include research associates who are working on research grants administered by senior faculty members, and trainees who are receiving advanced training, frequently under grants from the National Institutes of Health.

The whole subject of post-doctoral study is becoming so complex that, at the request of Johns Hopkins, it is being studied on a national scale by the Association of American

Universities. The financial aspects of the various post-doctoral programs will require particular attention. All the departments at Johns Hopkins that administer these programs have profited greatly from their stimulating effects upon research and teaching. On the other hand, the presence of such a large number of post-doctoral students, for whom the University seldom receives the tuition and other fees required of undergraduate and graduate students, but who do require space, equipment, and the time of senior faculty members, has imposed a large financial burden which must somehow be lightened. I think we must look to the various government agencies and to the foundations who support the bulk of these programs to coöperate in the solution of this vexing problem.

Another aspect of post-doctoral study which concerns me is its overwhelming concentration in the physical and life sciences. Since the very real dilemmas of the "knowledge explosion" are most pronounced in these areas, it is perhaps only natural that the great majority of post-doctoral students are found in such fields as medicine, public health, chemistry, biology, and physics. There is need, however, for more support of such programs in the social sciences and the humanities. These areas are also concerned with the problems of multiplicity and the necessity for more effective integration. Historians and philosophers, as well as biologists and physicians, can profit immensely from one or more years of rigorous study beyond the doctorate.

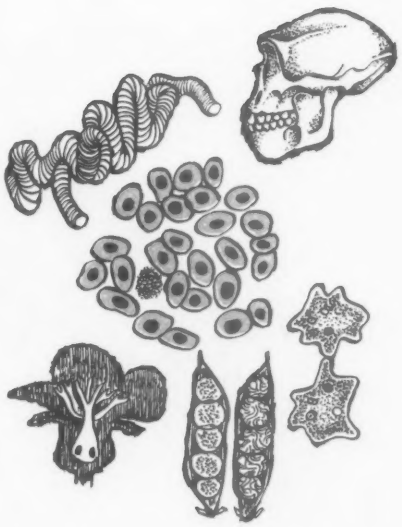
As one effective answer to the dilemmas of multiplicity, there can be little doubt but that post-doctoral programs will continue to grow. Our universities must see to it that these programs are conducted with the greatest possible benefit to the totality of human understanding.

INTERNATIONAL STUDIES

THE SEARCH for unity in multiplicity is carried on at many different levels and in many different ways. Some of the current and projected activities of the Johns Hopkins School of Advanced International Studies in Washington provide evidence of a many-sided effort to achieve unity of understanding and purpose in the vitally important field of international relations. This effort is sustained by two fundamental premises: first, that an interdisciplinary approach is essential to understanding vexing world problems; and second, close personal contacts among students, faculty, government and business personnel, and foreign specialists and scholars are necessary and desirable. So fruitful has been the work of this youngest of the University's schools that we may fairly claim that today it stands pre-eminent as a center of international studies.

One year ago, the Ford Foundation announced its support of a new and expanded program of SAIS in the amount of $3,000,000. Today, with additional generous grants from the Rockefeller, Kellogg, Old Dominion and Avalon Foundations, and the Carnegie Corporation, the University has reached the original goal of $4,247,000—the amount needed to put the new plan into effect.

Happily coinciding with this massive financial support is the announcement of the acceptance of the deanship of SAIS by Dr. Francis O. Wilcox. He succeeds Dean Philip W. Thayer, who, having passed retirement age after serving devotedly since 1948 when the School was in its infancy, agreed to carry on until Dr. Wilcox could assume the office. This was to occur after the recent session of the United Nations General Assembly where Dr. Wilcox served as U. S. delegate in his capacity as Assistant Secretary of State for International Organization Affairs.



Under the leadership of Dean Wilcox, the faculty will be enlarged and strengthened to give depth and breadth to the area studies program and to permit an increased emphasis on research. With added assistance under the terms of the National Defense Education Act and from the Kellogg Foundation grant, present programs in Arabic Language and Area studies and Latin American Studies specifically will be strengthened. The student body will be somewhat enlarged, and prospects are good for providing the School with an urgently needed new physical plant and locating it near the Brookings Institution where the two organizations may complement and benefit from each other's efforts.

The Hopkins constituency may well be proud of the past record and future promise of the School of Advanced International Studies. The following facets of its total program seem particularly noteworthy:

▶ The combination functional and area study program has proved to be extremely well designed to meet the basic purpose of the School—the education in depth of young men and women who seek careers in international service with government, business, and other organizations. The functional approach emphasizes training in essential tool disciplines such as diplomacy, international economics, and international law. This necessary functional training is tempered and given a practical bias through concentrated study of a major area of the world. At the present time, area programs are offered in the fields of Africa, Asia, Western Europe, Latin America, the Soviet bloc, and the Middle East. Intensive foreign language study is a significant part of the program of every SAIS student.

▶ The School's overseas centers have pioneered in research and training in international affairs. The most important of these is the Bologna Center, which enjoys close association

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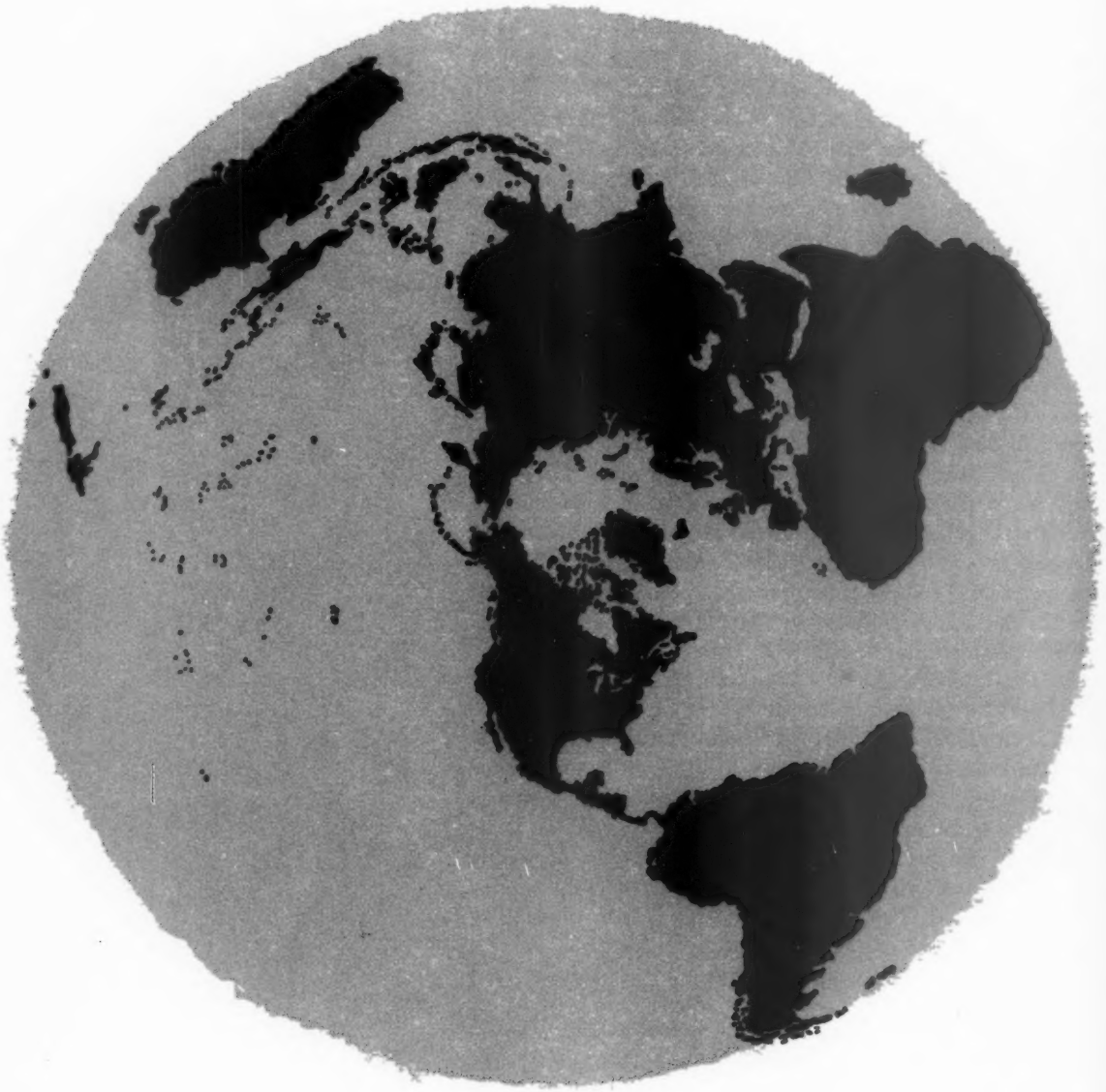
A polar projection map shows the compactness of the world and the inescapable involvement of all nations with each other.



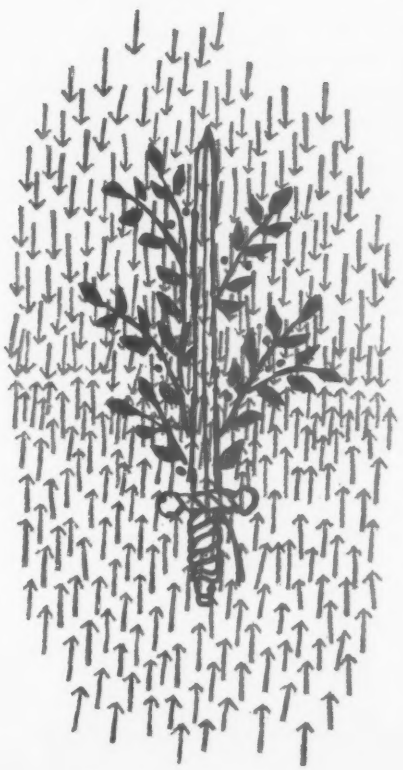
with the ancient and distinguished University of Bologna. The Center employs its own faculty and a program of studies which is basically American in method. The student body of the Center is distinctly international in flavor. Of a total enrollment of sixty-two, twenty-eight are Americans, thirty-three are European, and one is Asian. The success of this educational experiment in international understanding can be measured by the growing number of fellowships that have been offered by various European governments and business organizations.

The search for unity has taken a very positive form at the Bologna Center in that a course in "European Integration" is required of all students in the international studies program. Another development of great importance in this connection was the inauguration of an American Studies Program at the beginning of this academic year. This program was made possible by a grant of funds from the United States Government and by substantial contributions from public-spirited Italian citizens. The American Studies Program will benefit from a soon-to-be-completed new library which will house a 100,000 volume collection of American sources, the largest such collection in Europe. The Center will thus become a focal point for European scholars who specialize in American affairs.

▶ The Washington Center of Foreign Policy Research, an affiliate of SAIS under the direction of Dr. Arnold Wolfers, continues its productive work toward bringing theoretical concepts and practical experience in international politics closer together. It seeks to attain its objective by enabling academicians and practitioners to collaborate in making theory more pertinent to practice and endowing practice with the insights gained by theory. A recent publication of the Center, *Alliance Policy in the Cold War*, has achieved acceptance as a definitive work in the field and is being used extensively as a text. Research contracts undertaken by the Center on behalf of legislative and executive agencies have resulted in two recent significant studies: one on the subject of "Developments in Military Technology and Their Impact on United States Strategy and Foreign Policy" and the other entitled "The Purposes of United States Military and Economic Assistance."

▶ Seminars in diplomacy for the benefit of junior officers in the embassies of newly independent countries are being conducted by the School during the current academic year. This program is being supported by a grant from the Carnegie Endowment for International Peace.

All of these and many other current and projected activities at SAIS substantiate my belief that the School will play a role of ever-increasing importance in the crucial and demanding sphere of international relations.



THIS THEN is some of the evidence. From the almost incredible range of the current activities at Johns Hopkins there emerges this concrete proof that a community of scholars is moving to fulfill the free university's historic role. In the expansion of knowledge lies the hope of mankind that the ancient scourges of war, disease, and famine can be banished from the earth. But the "knowledge explosion" of recent years has increasingly led to what may be described as fragmented chaos. In this road there is danger as well as hope, for it is not inconceivable that unintegrated and half-digested knowledge may create forces which defy control.

The free university must never forswear its efforts to achieve integrated understanding. The importance of this appears greater with every passing day. I am reassured that the problems of multiplicity are so well understood at Johns Hopkins and that we are moving on a broad front to deal with them. In a few of our own efforts which I have attempted to describe above, I see compelling evidence to sustain my belief that the free university is the most valid symbol for our age.

A university president cannot eschew his responsibility to take a broad, perhaps even philosophical, view of the vast gamut of activities which are carried on in an institution so dynamic and complex as Johns Hopkins. But he has daily realization of the fact that successful fulfillment of a university's mission is largely dependent on considerations which cannot be neatly comprehended under any purely philosophical framework. Taken together, these aspects are the basic supports which undergird our towering academic achievements. The Hopkins constituency may well take pride in these areas of progress:

THE UNDERGRADUATE PROGRAM

FROM its beginning, the undergraduate program at Johns Hopkins has been geared to accommodate the young man of uncommon intellect and character in association with scholars of exceptional ability. The boundary lines between graduate and undergraduate study have been indistinct; a great number of upper-level courses are open to both, and undergraduates frequently participate in advanced and challenging research projects. That this philosophy of undergraduate education has been successful is evident from the fact that a high percentage of the recipients of Hopkins baccalaureate degrees continue on to advanced study.

The quality of the undergraduates continues to improve. Of the members of this year's freshman class, for example, 82 per cent finished in the top quarter of their secondary school classes. The median college Board Aptitude score for the class was 612 in the verbal test and 630 in the mathematical test. A year ago, the figures were 573 and 621 respectively.

Serious thought has been given in the past few years to the nature of the undergraduate program. Essentially the University has reaffirmed its faith in the liberal arts principle of collegiate education. Every undergraduate during his first two years is expected to acquire a core of knowledge consisting of course work and independent study in languages, literature, history, mathematics, philosophy, and the natural and social sciences. This core provides a liberal base for the more specialized work of the upperclass years. In their junior and senior years many students will naturally gravitate to departmental major programs in fields such as history, chemistry, and political science. On the other hand, there are a number of students, particularly those who desire a broad foundation for later professional study in medicine, law, theology, or business, for whom specialized departmental programs are inadequate. To meet the needs of such students, the *liberal arts major* has been instituted. While students who choose this program do specialize to some extent in a selected area of concentration, there is considerable opportunity for them to continue exploring in various fields of knowledge.

Most students choose to meet the general education requirements in their first two years of residence. However, for a small group of undergraduate students who are sure at the outset of their future area of specialization, opportunity exists to acquire some depth of knowledge in a given discipline during the first two years. These students do not escape the core requirements but they can postpone their fulfillment until the upperclass years.

Great progress has been made at the University toward increasing the effectiveness of our academic counseling. Experienced faculty members devote themselves to insuring that every student is able to take maximum advantage of the University's intellectual resources. There is need, however, for an expanded program of non-academic counseling. We are planning to use mature graduate students as resident counselors in the Alumni Memorial Residences. The counselors, each of whom will serve for two or three years, will serve as first point of contact with students who need advice, and will work closely with the existing Psychological Clinic and the dean of students. Presently there are three such counselors; with the addition of four more, I think we shall be able to provide the type of counseling program which our students need and deserve.

FINANCES

In the fiscal year 1959–60, for the first time in fifteen years, all the schools and divisions of Johns Hopkins operated without a deficit. This encouraging development is made more significant by the fact that basic academic salaries in the Faculty of Philosophy, the School of Engineering, and the School of Advanced International Studies have been raised on the average nearly 50 per cent since 1955–56. Raising faculty salaries has been one of our chief goals, and much remains to be done in this area. Many of our professors still do not receive compensation commensurate with their contributions to society.

The private university in this age seems destined to be plagued by financial problems. And the situation is not likely to change as long as tuition pays less than half the real cost of a student's education. A tuition increase of $250 a year to $1,450 becomes effective in September of 1961. This will improve the situation, but the University must continue to rely on the generosity of foundations, corporations, and individuals to meet its financial obligations.

The modern university is a tremendous fiscal undertaking. Current expenditures for operations in 1959–60 totaled $53,589,740. In addition, $111,311 was spent for physical plant, and reserves of $616,765 were set up to finance pending capital projects. Current income for operations during 1959–60 was $54,486,257.

Although the immediate financial health of the University is good, there are critical areas which must be attended to if Johns Hopkins is to continue to meet its unusually high standards of excellence.

THE PHYSICAL PLANT

Although the University is essentially a community of men, it has become clear that bricks and mortar are increasingly important in modern scholarship. The changing nature of research and education, which requires extensive laboratory equipment and complex machinery, makes physical plant a high priority consideration. In some areas we have reached the point where the lack of physical facilities is impeding our academic mission. This we must not permit.

To rectify the situation, and to equip Hopkins to enter vital new areas of scholarship, a number of new buildings are under construction or in advanced stages of planning. Ground was broken in the fall for a six-story laboratory wing on Mergenthaler Hall to provide needed research facilities for our distinguished department of biology. Intensive work is under way to construct a $2,500,000 addition to Rowland Hall to overcome the crowding and obsolescence of our present physics research facilities.

At the northern tip of the Homewood Campus, the Carnegie Embryological Laboratory is nearing completion. For many years, the Carnegie Institution has had close relationships with Hopkins and has maintained its Laboratory on the medical campus.

A new radiation laboratory building will soon be going up on the Homewood Campus. Closely allied with the department of electrical engineering, this laboratory conducts basic research in electrical engineering and physics of interest to the Air Force.

On the medical campus, the completion of the 14-story Clinical Science Building and the 11-story basic science building has provided facilities essential for both research and medical training. A new biophysics building will soon be completed, and soon to be undertaken is the construction of a wing on the School of Hygiene to house studies in the broad field of radiological science.

Work is to begin immediately on the new $11,000,000 Children's Medical Center, which will become a 265-bed addition to the Hospital and will provide facilities for study and training in diseases of young people by the Medical Faculty.

In East Baltimore the University and Hospital have coöperated with city and private firms to improve and change the appearance of the neighborhood. The Sheraton-Baltimore Inn has opened; a new 11-story office and apartment building is being constructed; a shopping center has been developed—all in close proximity to the new medical student dormitory and housing for married students.

As I mentioned earlier in this report, resources are now available for a badly needed new building at the School of Advanced International Studies in Washington. The new American library of the Bologna Center of SAIS is to be dedicated in April.

These are some of the major building projects. There are others equally important in their way. Vast as the program of construction may seem to be, it is but the minimum determined to be necessary to permit Hopkins to meet success in its vital academic mission, and to maintain its leadership in higher education.

SPONSORED RESEARCH

Two EARTH satellites, conceived, designed, and constructed at the Johns Hopkins Applied Physics Laboratory, are now circling the globe approxi-

mately every two hours. These satellites—Transit 1B and Transit 2A—represent the initial stages of Project Transit, a program aimed towards the development of a world-wide, all-weather navigation system. Using this system, observers with suitable receiving apparatus will be able to determine their position anywhere on earth or in the air with a precision never before attained except by the most advanced astronomical methods.

Project Transit demonstrates the kind of free and creative thinking which characterizes the University's government-sponsored research. The idea for Transit grew out of the curiosity of a few APL scientists who listened to Sputnik I on their own time late in 1957 with equipment they built. These people believed that there was sufficient information in a single doppler frequency-time curve obtained at one station to determine precisely the complete orbit of an earth satellite. The extraction of this information was a *tour de force* of mathematical analysis.

The scientists then proceeded a step further and reasoned that an observer at an unknown point on earth could determine his position precisely from doppler measurements on radio frequencies transmitted from a satellite traveling in an orbit whose parameters he knew.

The significance of this was instantly recognized by the U. S. Navy, which sponsors APL's work, and a unique satellite navigation system was born. Eighteen months later an idea had become a startling physical fact.

This is a dramatic example of the successful collaboration between the University and the government. Johns Hopkins can be proud of conducting research that is essential to the national welfare and security.

Though the Applied Physics Laboratory is the largest sponsored research undertaking of the University, other important work is being done for government agencies within the Institute for Cooperative Research and the Operations Research Office.

TO BE a valid symbol for this age, the free university must transcend it and reach into the future. Only by moving ever forward, only by molding the shape of tomorrow can the university truly remain a symbol of power and meaning.

On the preceding pages, I have outlined a few representative plans for Johns Hopkins in the coming years. They are by no means Utopian; on the contrary, they are plans which must be realized if Johns Hopkins is to be successful in its historic mission.

To accomplish these things, we will need very substantial support. In this respect, the Ford grant is a special event of major significance—not only because of its size, but because it is unrestricted. We have not been directed to use the money for this or that project. Instead, we have the opportunity to look imaginatively yet constructively into the future, to meet not only the pressing needs of today, but also the projected needs of the future.

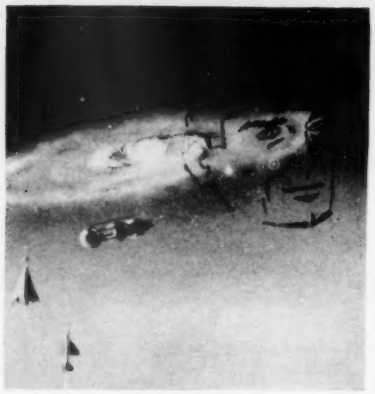
Johns Hopkins was selected as a recipient of the Ford grant because, in the words of Dr. Henry T. Heald, the President of the Ford Foundation, it is already "embarked on a future-development program commensurate in scope, imagination, and practicability to the vast needs of American society."

The grant is unrestricted, but not unconditional. We shall have to match every dollar of Ford funds with two dollars obtained from other private sources. It will require a massive effort on the part of the entire Hopkins constituency to raise the necessary $12,000,000. Expected grants from foundations and business corporations will help, but there is no escaping the fact that the support of Hopkins alumni will be vitally needed. Unless we can obtain this support, rendered generously and enthusiastically, the University will find itself in a difficult position. If those who know Johns Hopkins best, who have profited most from its dedication to truth and excellence, do not rally behind the standard—then how in all logic can we expect support from foundations and business organizations who frequently know us only by reputation?

In the past four years I have been privileged to meet with groups of Johns Hopkins alumni throughout the length and breadth of this country. I have never failed to be impressed on these occasions with the sincere interest which is manifested by our graduates in the affairs of their University. This is all the more remarkable when we consider the diversity of the alumni body, representing graduates of a wide variety of schools holding more than twenty different kinds of degrees. I think this unity in diversity was well explained by Woodrow Wilson who, speaking for the alumni at the twenty-fifth anniversary celebration of the University, said that the graduates of Johns Hopkins had taken from the University "an ideal which has lifted their lives to a plane they might not otherwise have attained; an ideal . . . of the service of truth not only, but of the service through truth, of the country of which they are citizens."

From my own knowledge of the Hopkins alumni body I have no doubt whatever that the support so vitally needed in the coming months will be forthcoming.

—MILTON S. EISENHOWER



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EVENTS AT JOHNS HOPKINS

VARSITY SPORTS

BASKETBALL—Johns Hopkins vs. CATHOLIC UNIVERSITY on Friday, Feb. 3 (away); M.I.T. on Saturday, Feb. 4 (Homewood Gymnasium at 8:15 p.m.); LOYOLA on Wednesday, Feb. 8 (Homewood Gymnasium at 8:15 p.m.); URSINUS on Saturday, Feb. 11 (away); DREXEL on Monday, Feb. 13 (Homewood Gymnasium at 8:45 p.m.); LOYOLA on Wednesday, Feb. 15 (away); HAMPDEN-SYDNEY on Saturday, Feb. 18 (Homewood Gymnasium at 8:15 p.m.); DICKINSON on Tuesday, Feb. 21 (away).

FENCING—Johns Hopkins vs. MUHLENBERG on Saturday, Feb. 11 (Homewood Gymnasium at 2 p.m.); STEVENS INSTITUTE on Wednesday, Feb. 15 (Homewood Gymnasium at 4 p.m.); TEMPLE on Saturday, Feb. 18 (away); HAVERFORD on Saturday, Feb. 25 (away).

WRESTLING—Johns Hopkins vs. DREXEL on Saturday, Feb. 4 (Homewood Gymnasium at 3 p.m.); DICKINSON on Saturday, Feb. 11 (away); SWARTHMORE on Tuesday, Feb. 14 (Homewood Gymnasium at 8 p.m.); URSINUS on Saturday, Feb. 18 (away); CATHOLIC UNIVERSITY on Saturday, Feb. 25 (Homewood Gymnasium at 2 p.m.).

NOTE—No admission fee is charged at Johns Hopkins home athletic events, but an admission card is required. Persons who wish to attend games during the present university year may obtain a card without charge by sending a stamped, self-addressed envelope to the Department of Physical Education, the Johns Hopkins University, Baltimore 18, Maryland. Alumni of the University should address their requests for admission cards to the Alumni Relations Office, the Johns Hopkins University, Baltimore 18, Maryland.

DRAMA

THE SERVANT OF TWO MASTERS—The Johns Hopkins Playshop will present eight performances of the Goldoni farce. (Thursday through Sunday, Feb. 9–12 and Feb. 16–19, at 8:30 p.m. in the Barn at Homewood.)

SPECIAL EVENTS

COMMEMORATION DAY—The eighty-fifth anniversary of the University's founding will be marked by formal exercises on Wednesday, Feb. 22, at 3 p.m., in Shriver Hall. The Hon. Christian Herter will be the speaker.

BALTIMORE SYMPHONY ORCHESTRA—The second of a series of three concerts by the Baltimore Symphony Orchestra on the Homewood campus will be held in Shriver Hall, Sunday, Feb. 19, at 4 p.m. (Tickets are available through the Student Music Program, Shriver Hall.)

Continued on page 32

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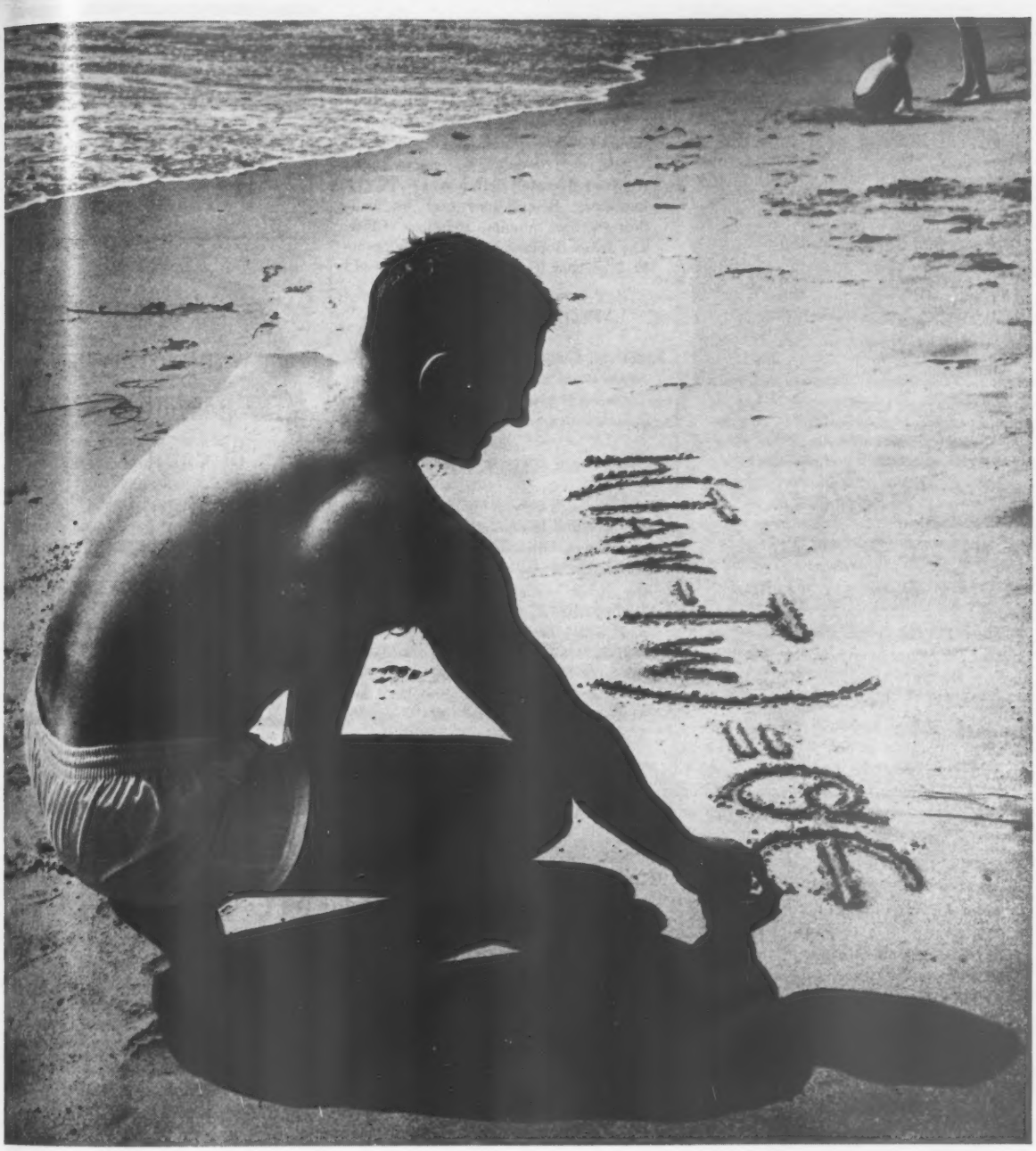

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GUEST LECTURER—Arnold J. Toynbee, British historian, will deliver a lecture titled "The Question of Uniqueness" in Shriver Hall on Sunday, Feb. 19, at 8 p.m. Open to the public.

JOHNS HOPKINS ALUMNI ASSOCIATION—The annual Commemoration Day banquet will be held on Wednesday, Feb. 22, at 6 p.m. at the Sheraton-Belvedere Hotel in Baltimore. Reservations may be made through the Alumni Relations Office, The Johns Hopkins University, Baltimore 18, Maryland. (Speaker will be announced.)

MEDICAL MEETING

THE JOHNS HOPKINS MEDICAL AND SURGICAL ASSOCIATION will hold its biennial meeting Thursday through Saturday, Feb. 23–25, in Baltimore.

EXHIBITIONS

MEDALS—An exhibition from the numismatic collections of the University, showing the development of medallic art from the sixteenth century to modern times. Open to the public without charge. (Evergreen House, 4545 N. Charles St., from 2 to 5 p.m. daily, through March 31.)

ART EXHIBITION—The work of Anne Lebow and Sally Finegold will be displayed in the Medical Residence Hall, Broadway and McElderry Street, daily from 9 a.m. to 5 p.m., through February. Open to the public without charge.

Acknowledgments

COVER II, Robert Phillips; PAGE 1, Alan J. Bearden and Robert Phillips; PAGE 2, Robert Phillips; PAGE 3, Robert Phillips; PAGE 4, M. E. Warren; PAGE 5, Noel Clark; PAGE 10, William C. Hamilton; PAGE 29, Richard C. Thompson.

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